THE TAXONOMY OF BENTHOVOLUTA HILGENDORFI (VON MARTENS) AND ALLIED TURBINELLID GENERA (MOLLUSCA: VOLUTACEA)

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Abstract. The turbinellid species *Benthovoluta hilgendorfi,* believed to be endemic to Japan, is recorded from a specimen collected by Dr Th. Mortensen's Pacific Expedition of 1914-16 at Zamboanga, Philippine Islands. The genera *Ptychatractus, Metzgeria, Benthovoluta, Surculina* and *Ceratoxancus* are assigned to the subfamily Ptychatractinae, in the family Turbinellidae. The New Zealand genus *Chathamidia* is removed from the Muricidae and transferred to the Turbinellidae, in the synonymy of *Surculina.*

Species of the subfamily Ptychatractinae inhabit deeper and cooler waters with an approximate benthic range extending from 100-1067 fathoms (183-1953m). They have been recorded from Japan, the Philippines, New Zealand, the Galápagos Islands, California, the Gulf of Panama, Bering Sea, Caribbean, N.W. Atlantic, the Azores and the North Sea. Presently 17 species are referable to the ptychatractine Turbinellidae.

Family TURBINELLIDAE Swainson, 1840

Subfamily PTYCHATRACTINAE Stimpson, 1865

1865. Ptychatractidae Stimpson, Americ. J. Conch., 1: 59.

Stimpson's family-group name (1865) has been utilised in a subfamilial sense for the 5 deep water turbinellid genera which contain species with fusiform, moderately thin shells with convex whorls and a sculpture of moderately broad axial ribs and spiral striae. The outer lip is usually thin, the columella is either edentulous or has 2-3 folds and the siphonal canal is produced, straight or recurved. The size ranges from 20.0 to 90.00mm, and the operculum, when present, is small, thin and translucent and has a terminal nucleus. The radular ribbon is very small, formula 1-1-1, rachiglossate, the rachidians have an arched base and 3 cusps, the laterals are simple, hooked and unicuspid with a swollen base and are similar to the laterals of Muricidae and Vexillidae. Species of Ptychatractinae differ from other groups of Turbinellidae in features of lighter, more fusiform and slender shell, narrow, elongate aperture, a produced siphonal canal and a distinctly different radular pattern. Species of Ptychatractinae were usually assigned to the Volutidae, Fasciolariidae, Turridae and Muricidae, and a summary dealing with the transfer to the Turbinellidae has been given by Rehder (1967).

Genus **Ptychatractus** Stimpson, 1865

Ptychatractus Stimpson, 1865, Americ. J. Conch., 1: 59. Type species by OD *Fasciolaria ligata* Mighels & Adams, 1842.

Shell small, 18.0-25.0mm in length, fusiformly ovate, buccinoid in appearance, whorls convex, sculptured with spiral threads but no axial ribs. Aperture oblong ovate, smooth within, outer lip thin, columella with 2 weak folds, canal moderately produced,

straight or recurved. Operculum present, small. Radula with a deeply arched, tri-cuspid rachidian and simple, elongated, hook-shaped laterals.

Ptychatractus ligatus (Mighels & Adams, 1842) (Fig. 3)

1842. *Fasciolaria ligata* Mighels & Adams, Boston J. Nat. Hist., 4: 51, pl. 4, fig. 17 (Mingan, Gulf of St. Lawrence).

1865. *Ptychatractus ligatus* (Mighels & Adams), Stimpson, Americ. J. Conch., 1: 59, pl. 8, fig. 8 (radula); 1881 Tryon, Man. Conch., 3: 72, pl. 40, fig. 185; 1901 Whiteaves, Cat. Mar. Invert. E. Canada, Ottawa, p. 191.

This small, *c.* 20.0mm long, operculate species has been recorded from the Gulf of St. Lawrence and Nova Scotia, N.W. Atlantic.

Ptychatractus occidentalis Stearns, 1873 (Fig. 14)

1871. *Ptychatractus occidentalis* Stearns, Conch. Memoirs, 12: 3 *(nomen nudum)*; 1873 Stearns, Proc. Calif. Acad. Sci., 5: 79 (Nagai Shumagin Is., Aleutian Is.); 1921 Dall, U.S. Nat. Mus. Bull., no. 112: 87, pl. 6, fig. 8; 1927 Oldroyd, Mar. shells W. coast Nth. America, 2 (1): 175, pl. 7, fig. 1.

The species is similar to *P. ligatus* and lives in the Bering Sea, North Pacific.

Ptychatractus californicus Dall, 1908

1908. *Ptychatractus californicus* Dall, Bull. Mus. Comp. Zool. Harvard, 43 (6): 299 (off San Diego, California, 822 fathoms (1504m); 11.0 × 5.5 × 5.5mm).

Genus **Metzgeria** Norman, 1879

Metzgeria Norman, 1879, J. Conch., 2: 56. Type species (art. 67 (i) of ICZN) *Lathyrus albellus* Dunker & Metzger, 1874 = *Latirus albus* Jeffreys in Thomson, 1873 (*nom. subst. pro Meyeria* Dunker & Metzger, 1874).

1874. *Meyeria* Dunker & Metzger, Jahrb. deut. Malakozool. Gesell., 1: 150. Type species by M *Lathyrus albellus* Dunker & Metzger, 1874 = *Latirus albus* Jeffreys in Thomson, 1873 (non *Meyeria* McCoy, 1849, in Crustacea).

The genus contains 2 species from the North Sea and East Atlantic. The species are small, 20.0-25.0mm in length, fusiform, with convex whorls, axial ribs and spiral threads. The siphonal canal is slender and produced, straight or recurved, and the columella has 2 weak folds. The operculum has a terminal nucleus. The radula has rhomboidal, weakly excavated and tricuspid rachidians, with laterals simple, sickle-shaped and unicuspid.

Metzgeria alba (Jeffreys in Thomson, 1873) (Figs. 6, 15)

1873. *Latirus albus* Jeffreys in Thomson, Depths of the Sea, p. 464, fig. 77 (North Sea).

1881. *Meyeria alba* Jeffreys, Tryon, Man. Conch., 3: 73, pl. 39, figs. 190-193.

1929. *Metzgeria alba* (Jeffreys), Thiele, Handb. syst. Weicht., 1: 343, fig. 409 (radula); 1968 Nordsieck. Europ. Meeres-Gehäuseschnecken, p. 150, pl. 25, fig. 85.00.

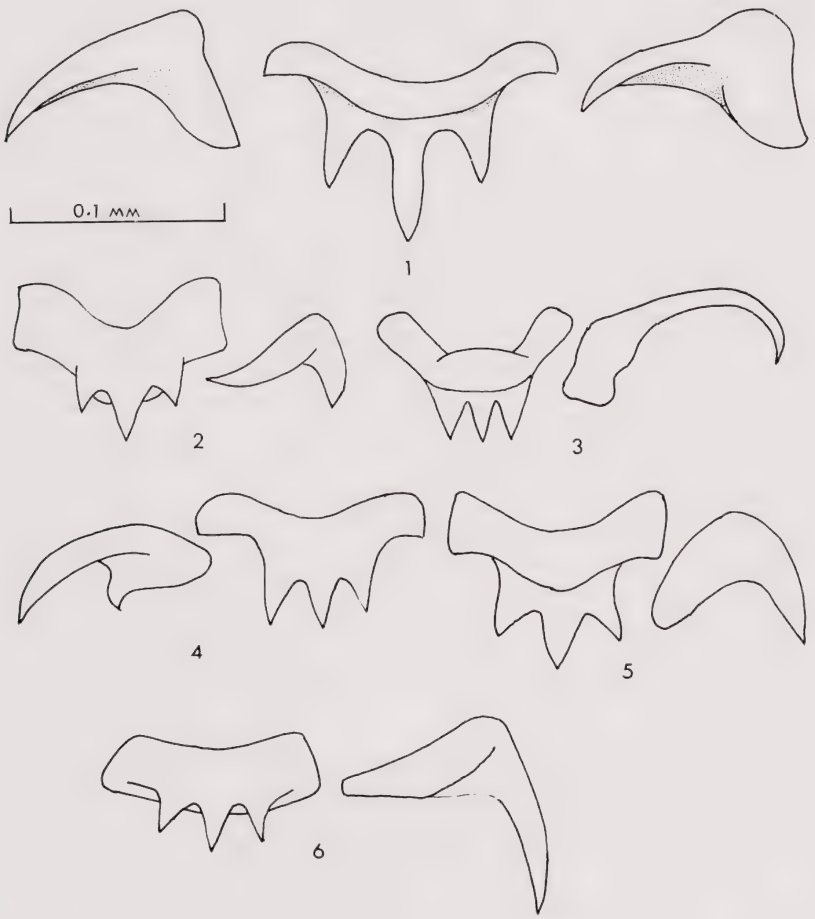
The species lives in the North and Norwegian Seas and attains a size of about 30.0mm.

Metzgeria decorata (Locard, 1897)

1897. *Meyeria decorata* Locard, Exped. sci. trav. Talisman, p. 337 (Azores, 1258m).

1968. *Metzgeria decorata* (Locard), Nordsieck, Europ. Meeres-Gehäuseschnecken, p. 150, pl. 25, fig. 85.01.

This species from the Azores is similar in size and form to *M. alba,* but has more prominent spiral threads which override the axial ribs and become nodulose at the point of intersection.



Figs. 1-6. Radulae — one or half a transverse row. 1. *Benthovoluta hilgendorfi* (von Martens). Zamboanga, Philippine Is, 450m. 2. *B. meekiana* (Dall). Off Morro Light, Cuba, 400 fathoms (732m) (after Bayer 1971, fig. 55D). 3. *Ptychatractus ligatus* (Mighels & Adams). Coast of Maine or Nova Scotia (after Stimpson 1865, pl. 8, fig. 8). 4. *Surculina cortezi* (Dall). Probably from California (after Rehder 1967, textfig. 10). 5. *S. expeditionis* (Dell). Chatham Rise, New Zealand, 260 fathoms (476m) (after Dell 1956, fig. B15). 6. *Metzgeria alba* (Jeffreys in Thomson). Probably from the North Sea (after Thiele 1929, textfig. 409).

Genus **Benthovoluta** Kuroda & Habe, 1950

Benthovoluta Kuroda & Habe, 1950, Illust. Cat. Jap. Shells, no. 5: 37. Type species by OD *Phenacoptygma ? kiiensis* Kuroda, 1931 = *Voluta hilgendorfi* (von Martens, 1897).

Small to moderately large species, 20.0-90.0mm in length, fusiform and moderately thin, whorls convex, sculptured with axial ribs and spiral striae, axial sculpture becoming usually obsolete on the last whorl. Aperture narrow, fusiformly elongate, smooth within, outer lip thin, columella with 2-3 folds, first or second posterior fold largest; siphonal canal produced and straight. Operculum very small, thin, translucent yellowish-brown, 1.5-3.7mm in length. Radula with excavated, tricuspid rachidians and simple, sickle-shaped laterals.

Benthovoluta was described by Kuroda & Habe (1950) in the Volutidae and was transferred to the Turbinellidae by Kuroda (1965) who had earlier (1931) described the type species under the name of *Phenacoptygma ? kiiensis.*

Benthovoluta hilgendorfi (von Martens, 1897) (Figs. 1, 7, 8, 9, 10)

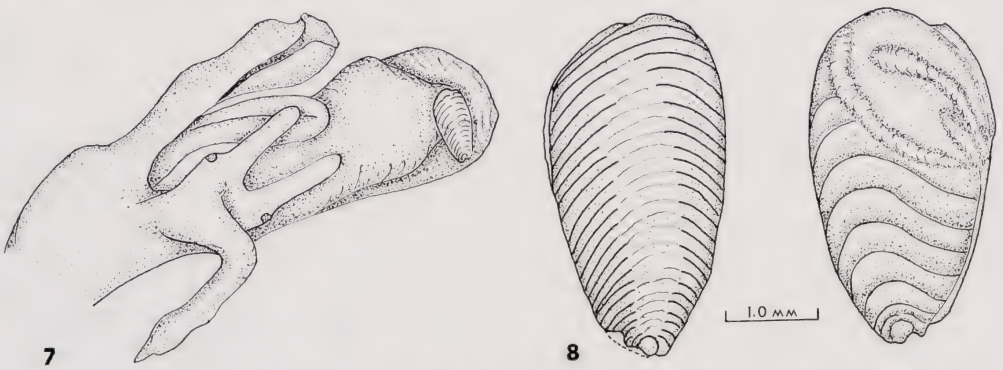
1897. *Voluta hilgendorfi* von Martens, Archiv f. Naturg., 63 (1): 176, pl. 17, fig. 1.

1920. ?*Mitra plicifera* Yokoyama, J. Coll. Sci. Imp. Univ. Tokyo, 39: 48, pl. 2, figs. 16a, b (Koshiba, L. Musashino, Miura Peninsula, L. Pliocene of Japan); 1952 Hatai & Nisiyama, Sci. Repts. Tohoku Univ. Sendai, ser. 2, Geology, Spec. vol. 3: 215; 1954 Taki & Oyama, Palaeont. Soc. Japan Spec. pap., no. 2, pl. 3, figs. 16a, b; 1972 Cernohorsky, Rec. Auckland Inst. Mus., 9: 223 (non *Mitra plicifera* S. V. Wood, 1848).

1931. *Phenacoptygma ? kiiense* Kuroda, Venus: Jap. J. Malac., 3 (1): 48, textfig. 1 (off Kii, Japan; 73.3mm).

1950. *Benthovoluta hilgendorfi* (v. Martens), Kuroda & Habe, Illust. Cat. Jap. Shells, no. 5: 37, pl. 5, fig. 2 and pl. 7, fig. 1, textfig. 4; 1952 Habe, Illust. Cat. Jap. Shells, no. 18: 132, textfig. 5; 1962 Kira, Shells west. Pacific col., 1: 92, pl. 33, fig. 3; 1963 Shikama, Select. shells world col., 1: 97, pl. 79, fig. 7; 1965 Kuroda, Venus: Jap. J. Malac., 24 (1): 50.

A specimen of *Benthovoluta hilgendorfi* collected by Th. Mortensen's Pacific Expedition (4.III.1914), 25 miles (40km) East of Zamboanga, Philippine Islands, in *c.* 450m, has been examined by the writer. This male specimen has an arched foot, tentacles and eyes, siphon, a large penis which is broad at the base, and an elongate-ovate, small, translucent corneous-yellow operculum with a terminal nucleus, size 3.7mm in a shell 87.0mm in length. The radular ribbon is 2.7mm in length and has 72 transverse



Figs. 7, 8. *Benthovoluta hilgendorfi* (von Martens). 7. Animal drawn from preserved specimen from Zamboanga, Philippine Is. ♂. 8. Dorsal and ventral view of operculum.

rows of teeth (+ 5 nascentes). The shell itself is dirty-white in colour, the aperture and columellar callus are cream and faintly suffused with brown; the antepenultimate whorl has 12 coarse axial ribs, 11-13 spiral threads on the penultimate whorl and 3 strong columellar folds of which the central one is the largest; the first posterior fold is bifurcate. The periostracum is straw-yellow, rough and mostly worn away, and viewed in profile, a shallow sutural sinus is discernible.

Rehder (1967) considered *Mitra plicifera* Yokoyama, from the Japanese Pliocene, to be a distinct species, whereas Japanese authors regard *M. plicifera* as a synonym of *Benthovoluta hilgendorfi*. The Pliocene *Mitra plicifera* does have more numerous and slender axial ribs (*c.* 20 on the spire whorls) and narrower interstices, but in view of the rather high degree of variability of sculpture in Volutacea, particularly the number and thickness of axial ribs, it is quite probable that *M. plicifera* is only a form of *Benthovoluta hilgendorfi*. Should, however, the Japanese Pliocene form be recognised as taxonomically separable, Yokoyama's *Mitra plicifera* will require a new name since it is a primary homonym of *Mitra plicifera* S. V. Wood, 1848, a vexillid from the coralline crag, Pliocene of England.

Benthovoluta meekiana (Dall, 1889) (Fig. 2)

1889. *Fasciolaria (Mesorhytis) meekiana* Dall, Bull. Mus. Comp. Zool. Harvard, 18: 172, pl. 36, fig. 7 (off Morro Light, Cuba, 250-400 fathoms (458-732m); 15.5 × 5.0 × 9.0mm); 1889 Dall, Bull. U.S. Nat. Mus., 37: 112, pl. 36, fig. 7.

1971. *Teramachia meekiana* (Dall), Bayer, Bull. Mar. Sci., 21 (1): 197, fig. 54 left and fig. 55D, E (off S.W. coast of Jamaica, Caribbean, 530-549m; 26.0 × 8.2mm).

Bayer (1971) recorded freshly dredged specimens from Jamaica and published figures of the radula. His location of *B. meekiana* and *B. chaunax* in the volutid genus *Teramachia* is, however, incorrect. Habe (1952) published figures of the radula of *Teramachia tibiaeformis* Kuroda, 1931, the type species of *Teramachia* Kuroda. The radula of that species is typically calliotectine volutid with only a single tricuspid rachidian per row and no laterals. Species of *Teramachia,* apart from their quite distinct radula, have shells sculptured with numerous, slender and sinuous axial ribs and obsolete spiral sculpture, and most important of all, channelled or indented sutures and a plaitless columella. The outer lip in *Teramachia* is basally constricted and the operculum is very large in contrast to the minute operculum of *Benthovoluta.*

Benthovoluta chaunax (Bayer, 1971)

1971. *Teramachia chaunax* Bayer, Bull. Mar. Sci., 21 (1): 198, fig. 54 right and figs. 55B, C (W. of St. Lucia, Caribbean, 201-589m; 28.0 × 8.4mm).

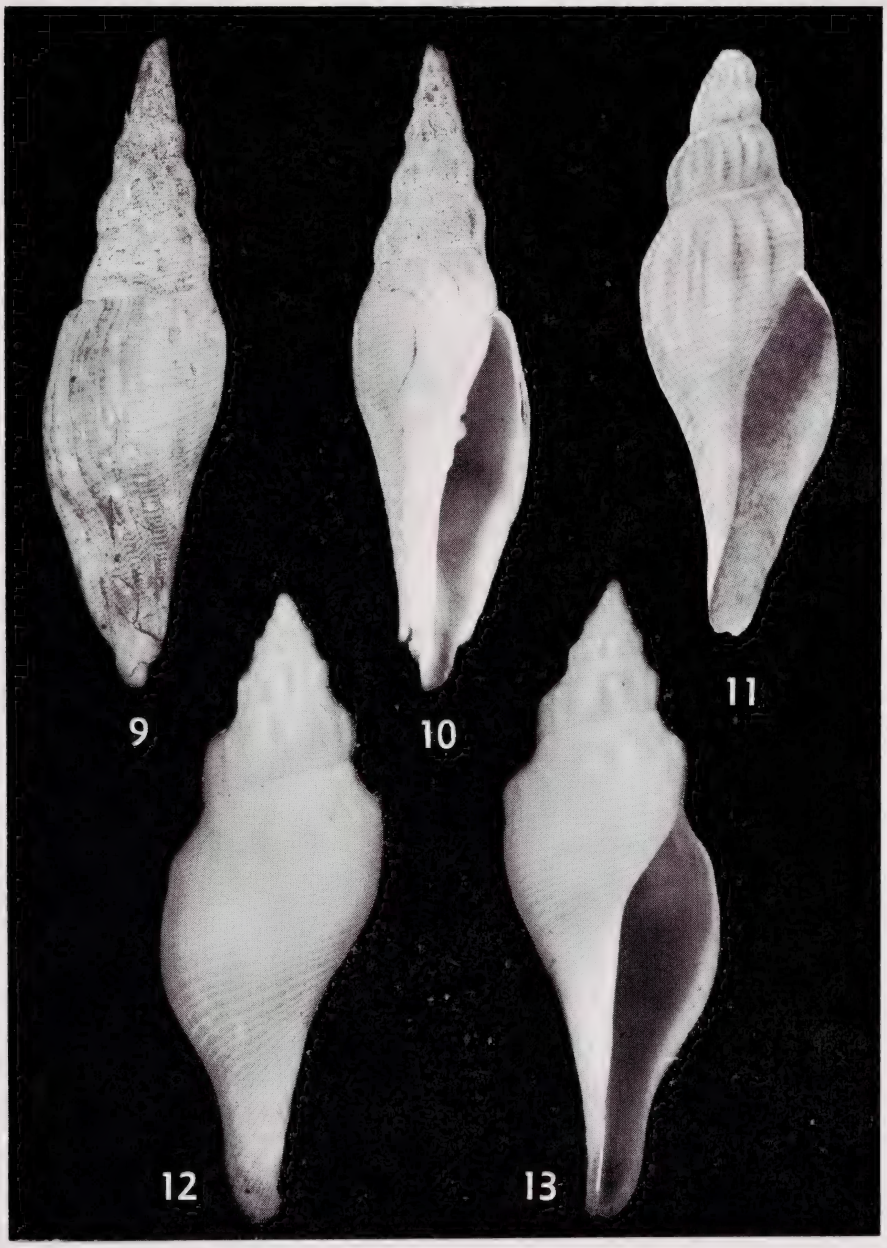
The species is similar to *Benthovoluta meekiana,* but the axial ribs are more prominent and persist to the body whorl. The radula as figured by Bayer (1971) is the most divergent among the Ptychatractinae: the rachidians have also an excavated base but have 6-7 cusps instead of the usual 3 cusps; the laterals are similar to those in *B. meekiana*, i.e. unicuspid and sickle-shaped.

Benthovoluta barthelowi (Bartsch, 1942)

1942. *Prodallia barthelowi* Bartsch, Nautilus, 56 (1): 12, pl. 2, fig. 2 (off Cagayan I, Jolo Sea, Philippine Is, 495 fathoms (906m); 27.3 × 8.3 × 5.8mm).

1970. *Teramachia barthelowi* (Bartsch), Weaver & du Pont, Living Volutes, p. 177, pl. 75, figs. C, D; 1971 Bayer, Bull. Mar. Sci., 21 (1): 196.

Weaver & du Pont (1970) described the species as having a plaitless columella and assigned it accordingly to the volutid genus *Teramachia*. *Benthovoluta barthelowi* has, however, 3 low and deep set columellar folds and closely resembles other species in this group, e.g. *B. meekiana* and *B. chaunax*. The radular anatomy of the species is still unknown and the placement in *Benthovoluta* requires confirmation.



Figs. 9-13. 9, 10. *Benthovoluta hilgendorfi* (von Martens). Off Zamboanga, Philippine Is, 450m; 87.0mm. 11. *Surculina cortezi* (Dall) (from Oldroyd 1927, pl. 13, fig. 7). 12, 13. Holotype of *Surculina expeditionis* (Dell). Chatham Rise, New Zealand, 260 fathoms (476m); 27.0mm, in Dominion Museum.

Benthovoluta costata (Dall, 1890)

1890. *Mesorhytis costatus* Dall, Proc. U.S. Nat. Mus., 12: 317, pl. 5, fig. 5 (Sth. of St. Kitts, Caribbean, 687 fathoms (1257m); 14.0 × 4.0mm).

The radula of this species is unknown and the type specimen appears to be immature; the columella has 3 folds. The species is placed in *Benthovoluta* on similarity of shell features with other species of the group.

Benthovoluta gracilior Rehder, 1967

1967. *Benthovoluta gracilior* Rehder, Pacific Science, 21: 185, textfigs. 5, 6 (off Cagayan, Nth. Sulu Sea, 508 fathoms (930m); 54.75 × 13.4mm).

This recently described species is the most turrid-like *Benthovoluta* on record; the outer lip is constricted and forms a long and narrow canal and the columella has 2 folds. The radula is unknown and the assignment to *Benthovoluta* requires confirmation.

Genus **Surculina** Dall, 1908

Surculina Dall, 1908, Bull. Mus. Comp. Zool. Harvard, 43 (6): 260. Type species by OD *S. blanda* Dall, 1908 (as *Daphnella (Surculina) blanda* on p. 291).

1918. *Phenacoptygma* Dall, Proc. Biol. Soc. Washington, 31: 138. Type species by OD *Daphnella (Surculina) cortezi* Dall, 1908.

1956. *Chathamidia* Dell, Dominion Mus. Bull., no. 18: 118. Type species by OD *C. expeditionis* Dell, 1956.

Species of the genus are similar in appearance to *Benthovoluta* but the columella is plaitless and according to Dall (1908) the animal lacks eyes, tentacles and an operculum. The radula has arched and tricuspid rachidians and the laterals are simple, unicuspid and sickle-shaped. Species range in size from 20.0 to 43.0mm. The type specimens of the 3 West American species have been illustrated by Rehder (1967).

Surculina blanda (Dall, 1908)

1908. *Daphnella (Surculina) blanda* Dall, Bull. Mus. Comp. Zool. Harvard, 43 (6): 291, pl. 3, fig. 1 (off Cocos I., Gulf of Panama, 1067 fathoms (1953m); 26.5 × 8.0 × 16.5mm).

1966. *Surculina blanda* Dall, Powell, Bull. Auckland Inst. Mus., no. 5: 137, pl. 22, fig. 7; 1967 Rehder, Pacific Science, 21 (2): 184, textfig. 7.

This species, like all other *Surculina* species, has adpressed sutures and convex whorls, but the axial ribs are usually lacking on the last 2 whorls.

Surculina cortezi (Dall, 1908) (Figs. 4, 11)

1908. *Daphnella (Surculina) cortezi* Dall, Bull. Mus. Comp. Zool. Harvard, 43 (6): 292 (off Cortez Bank, 984 fathoms (1801m); off San Diego, California, 639 fathoms (1169m); 39.0-43.0mm × 14.0 × 24.0-27.0mm).

1918. *Phenacoptygma cortezi* Dall, Proc. Biol. Soc. Washington, 31: 138; 1927 Oldroyd, Mar. shells w. coast Nth. America, 2 (1): 168, pl. 13, fig. 7.

1966. *Surculina cortezi* (Dall), Powell,, Bull. Auckland Inst. Mus., no. 5: 137; 1967 Rehder, Pacific Science, 21: 184, textfig. 8, 10 (radula).

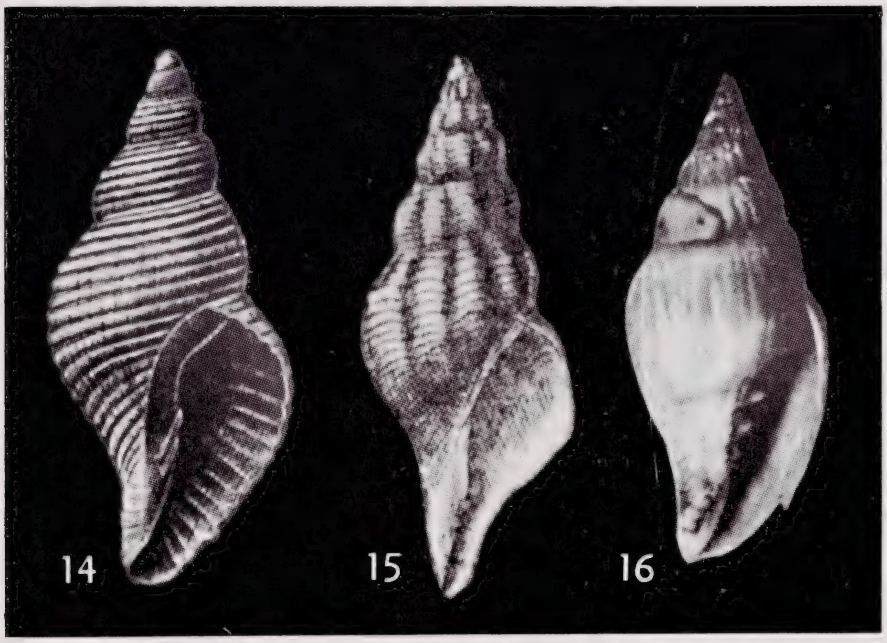
This second west American species is very similar to *S. blanda* but the axial ribs persist to the periphery of the body whorl.

Surculina galapagana (Dall, 1919)

1919. ?*Leucosyrinx galapagana* Dall, Proc. U.S. Nat. Mus., 56: 5, pl. 3, fig. 2 (off the Galapagos Is, 634 fathoms (1160m); 20.0 × 7.0mm).

1967. *Surculina galapagana* (Dall), Rehder, Pacific Science, 21: 184, textfig. 9.

This species has more pronounced turbinellid shell characters than the other 3 *Surculina* species; the whorls are more inflated and subangulate on the presutural ramp.



Figs. 14-16. 14. *Ptychatractus occidentalis* Stearns (from Dall 1921, pl. 6, fig. 8). 15. *Metzgeria alba* (Jeffreys in Thomson) (from Tryon 1881, pl. 39, fig. 191). 16. *Ceratoxancus teramachii* Kuroda. Off Tosa, Japan; 32.3mm (from Sakurai 1957, p. 162, fig. 4).

Surculina expeditionis (Dell, 1965) (Figs. 5, 12, 13)

1956. *Chathamidia expeditionis* Dell, Dominion Mus. Bull., no. 18: 118, pl. 16, figs. 159, 160 and fig. B15 (Chatham Rise, New Zealand, 220-290 fathoms (403-531m); 27.0 × 9.4 × 17.3mm).

The species, which was originally placed in the family Muricidae, closely resembles the West American *Surculina cortezi* (Dall), and undoubtedly belongs to the genus *Surculina*. It is an elongate-fusiform species, with a sculpture of angulate axial ribs which cease on the periphery of the body whorl, narrow spiral cords which flatten out on the body whorl, a smooth, plaitless columella and an elongate, spout-shaped siphonal canal. The radula as figured by Dell (1956) shows the species to be turbinellid.

Genus **Ceratoxancus** Kuroda, 1952

Ceratoxancus Kuroda, 1952, Publ. Seto Mar. Biol. Lab., 2 (2): 69. Type species by OD *C. teramachii* Kuroda, 1952.

Species of the genus are mitriform in appearance, moderate in size, of length 30.0-40.0mm, elongate-ovate to fusiform, and sculptured with numerous, slender axial

ribs and spiral threads. The columella has 3 folds, the outer lip is thin and convex in profile and the siphonal canal is moderately short. The radula is unknown and it is not known whether *Ceratoxancus* is operculate. The 2 species recorded in the genus are known only from Japan.

Ceratoxancus teramachii Kuroda, 1952 (Fig. 16)

1952. *Ceratoxancus teramachii* Kuroda, Publ. Seto Mar. Biol. Lab., 2 (2): 69, textfigs. 1-4; 1957 Sakurai, Venus: Jap. J. Malac., 19: 162, textfigs. 3, 4 (off Tosa, Japan).

The species is short, squat and mitriform, and bears a strong resemblance to Eocene-Miocene species of the volumitrid genus *Conomitra* Conrad; the columella has 3 well-spaced folds.

Ceratoxancus elongatus Sakurai, 1957

1957. *Ceratoxancus elongatus* Sakurai, Venus: Jap. J. Malac., 19: 161, textfigs. 1, 2 (off Tosa, Shikoku I, Japan, dredged in deep water; 40.85 × 14.9 × 23.2mm).

The species is more fusiform and elongate than *C. teramachii* and the sculpture is finely granulose.

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